Zero Retries issue 0002 2021-07-23

In this issue:

- **Request To Send (Editorial)**
- **The US Need More Radio Engineers**
- **Packet Radio Hardware in 2021**
- **ARDC, One More Time**
- **Feedback Loop**
- **Closing The Channel**

Request To Send

With the advent of YouTube, Amateur Radio is awash in content. I'm just gobsmacked with how *much* Amateur Radio content there *is* on YouTube. Some of it's quite good. For example, I really enjoy, and learn from watching conference presentations on a subject that I'm interested in such as the various Digital Communications conferences put on by TAPR, MicroHAMS, and Utah.

I'll confess to a very simple, basic worldview - I like to read. Not just for pleasure (though, I do a lot of that), but as I confessed in Issue 0000, I learn best by reading. For me, it's not nearly as efficient to absorb detailed, technical information from video as it is to read a good article. So, with me as Editor, that's what I plan to present in Zero Retries - lots of written, detailed, technical content.

You might tire of my solo voice in Zero Retries. I understand. It's in my long term plan for Zero Retries to feature voices other than mine. In time, perhaps regularly, such as "columns". Before I can do that, I'll have to develop some kind of business model that generates some revenue that will allow me to pay those other writers something reasonable. I really liked 73's payment philosophy - "We don't pay *much*, but we pay *fast*" which was apparently a dig at their competitor magazines.

Evolving Zero Retries sounds vaguely like a magazine, right? That's no accident - I love magazines. But magazines as we knew them (paid subscription, print, or paywall, or heavily DRM'd electronic versions, no publicly accessible archives) are creatures of the 20th century, and I think their time is over. Very few folks under forty have much use for magazines that are printed, or paywalled, or electronic versions with heavy Digital Rights Management (DRM). *I'll* mourn magazines, but change *is*, and the magazine business model (at least in Amateur Radio) *just hasn't changed*.

I'm a fan of the late Wayne Green W2NSD, publisher of 73 Magazine (and many other great magazines, including founding Byte Magazine). That Wayne started magazines, in the late 1950s through the 1990s, was a business model that worked in that era. We didn't have the Internet then (well, public access, anyway). I'm no Wayne Green, but I think that if Wayne was reincarnated in 2021, and had the same editorial chops, he'd be doing something like Hackaday. Make it maximally accessible (no paywall, or maybe some optional paid features), entertaining writing, and sell ads on it that people really want to see (no pandering with cars, or blenders, or clothing.)

I think there's room in Amateur Radio for something like Zero Retries or something like Hackaday that's rabidly focused on Amateur Radio, to grow and eventually thrive, with its content *not* hidden behind a paywall like what the Amateur Radio Publishing-Industrial Complex does. As for me, Zero Retries takes the form that I'm most comfortable with delivering (and reading) - long form writing in a newsletter format. Zero Retries won't be for everyone, and as each issue hits, I expect to see people unsubscribing. That's OK, and no hard feelings. With Zero Retries, I'm trying to build a community that has a shared interest in evolving Amateur Radio as a technology activity by people with a technology background (or, at a minimum, actually interested in technology), and building a path forward for Amateur Radio to becoming seen by many or most as relevant in the coming decades. As I'm becoming fond of saying, ***Nothing great has ever been accomplished without irrational exuberance.***

Despite that Zero Retries is categorically defined as a *news*letter, at least at the moment I don't intend it to be very "newsy", as in topical. I'd like to think that you could read Zero Retries days, weeks, or months later than its publication date, and still think the articles seem relevant and interesting… much like the story that follows below. Part of that is because I'm working weeks ahead to keep issues of Zero Retries in the auto-publish pipeline. Another factor is that Substack enforces an (unstated) limit on the length of an email newsletter in their system. At first I was frustrated when I bumped into that limit for Issue 0001 - "*I'm not done!"* I ended up bumping articles out of Issue 0001 into later issues. Giving it further thought, "Mother Substack" knows best (Substack publishes thousands of email newsletters now) and that limit is a good thing for you readers. There's only so much you want to read in an email.

One thing I've really grown to appreciate about Substack is that they support "a whole package" of independent content generation. Substack allows Zero Retries to be available via email, web browsing, and a Really Simple Syndication (RSS) feed. Substack also supports podcasts, which is something I'm considering as part of the evolution of Zero Retries. Podcasts are a fantastic tool for a newsletter like Zero Retries. My vision of adding podcasts into Zero Retries is to conduct interviews as part of Zero Retries, and then transcribe the interview as an issue of Zero Retries, and also publish the interview as a podcast for those that would like to listen to the interview. I'm also considering creating an audio version of each issue of Zero Retries, but that's a bit in the future. Of course, the core capability of Substack is that they allow independent content creators to "gate" (paywall) their content for paid subscribers. I'll use that capability with other newsletters I have in mind outside of Amateur Radio, but Zero Retries' content will remain publicly accessible with no paywall.

de N8GNJ

The US Need More Radio Technology Engineers

Apologies in advance for steering Zero Retries into what is probably a political discussion, but this discussion illustrates the Zero Retries vision of reimagining Amateur Radio as helping technical professionals (and experimenters) develop a fundamental understanding of radio technology (instead of just being users of radio technology, like administering Wi-Fi or Wireless ISP networks). In short, the US needs more… many more… people with deep technical understanding and capability to conceptualize, design, build, and operate radio technology, systems, and networks. And as this article reminds us, we also need them to be able to defend our country.

I have a very eclectic feed of news sources that serves me well as a "wide net" for my varied interests. Most of the sources I monitor are humans, not algorithms. Thus, sometimes a (human) news source mentions an article published some time ago that's gained new relevance. This is one such article from **Breaking Defense** from March, 2019 - US 'Gets Its Ass Handed To It' In Wargames: Here's A $24 Billion Fix. I began reading it out of casual interest, assuming the title was mostly clickbait. But as I read, chills started going up my spine and remember thinking "Oh crap, this is *serious!*" Some excerpts:

> "In our games, when we fight Russia and China," RAND analyst David Ochmanek said this afternoon, "blue gets its ass handed to it." In other words, in RAND's wargames, which are often sponsored by the Pentagon, the US forces — colored blue on wargame maps — suffer heavy losses in one scenario after another and still can't stop Russia or China — red — from achieving their objectives, like overrunning US allies.
>
> How could this happen, when we spend over $700 billion a year on everything from thousand-foot-long nuclear-powered aircraft carriers to supersonic stealth fighters? Well, it turns out US superweapons have a little too much Achilles in their heels.

A primary thrust of the article is the vulnerability of US carriers and aircraft bases. That's certainly serious, but that's not what alarmed me. This is what really alarmed me:

> *Worst of all, Work and Ochmanek said, the US doesn't just take body blows, it takes a hard hit to the head as well. Its communications satellites, wireless networks, and other command-and-control systems suffer such heavy hacking and jamming that they are, in Ochmanek's words, "suppressed, if not shattered."*
> *The US has wargamed cyber and electronic warfare in field exercises, Work said, but the simulated enemy forces tend to shut down US networks so effectively that nothing works and nobody else gets any training done. "Whenever we have an exercise and the red force really destroys our command and control, we stop the exercise," Work said, instead of trying to figure out how to keep fighting when your command post gives you nothing but blank screens and radio static.*
> *The Chinese call this "system destruction warfare," Work said: They plan to "attack the American battle network at all levels, relentlessly, and they practice it all the time."*

The fix (for the command and control systems)?

> The other big fix: toughening up our command, control, and communications networks. That includes everything from jam-proof datalinks to electronic warfare gear on combat aircraft and warships. The services are fond of cutting corners on electronics to get as many planes in the air and hulls in the water as possible, Ochmanek said, but a multi-billion dollar ship that dies for lack of a million-dollar decoy is a lousy return on investment.

What scares me even more than the problem, is the "solution". The command and control infrastructure (that's so vulnerable) is deeply embedded into *every US weapon and system more complex than a rifle*, including the *soldiers that carry radios and data units*. Fixing this fundamental issue is going to be an enormous challenge to "upgrade" to be more "jam proof". It's hard to grasp the scope of this challenge - satellites have to be "jam proofed", as do radios in aircraft, ships, tanks (and every other combat vehicle). My mind reels with the scope and complexity of this task.

What leaped to mind as I read the article was that most of all, this challenge is going to require a lot of very smart people who understand radio technology very, very well. I'm harping on the radio technology aspect of the article because *every* (external) communication in a plane, in a ship, in a tank, uses radio. It's one of the things that you learn very early as an Amateur Radio Operator… *it's easy to jam a radio signal*. It's so easy, it happens routinely without even trying. It's hard and expensive to design a radio system that can survive being jammed; fortunately such systems are possible. We set up elaborate (human) protocols such as net control operators to prevent accidental jamming. In Amateur Radio, we also have examples of what happens when someone malicious decides to deliberately jam communications (I'm told that 75 meters is particularly… lively…).

At the moment, the US is outmatched on the numbers - China's population is ~1.4B, and the US population is ~332M. What's not reflected in those numbers is that China trains a lot more technical personnel than the US. In China, becoming a technical professional, especially an Engineer, is a national imperative. In the US, becoming a technical professional, especially an Engineer, is cause for derision - we get called Nerds by the non-technical folks. Given that China is the largest manufacturer of cellular system infrastructure (Huawei) and that nearly every consumer electronic device that uses radio technology is manufactured in China, it seems a safe bet that China *trains a lot more technical personnel on radio technology* than the US does. We're not screwed… yet… but we're behind the curve on this issue.

The Zero Retries perspective on this issue is that the US needs a lot more people, with a lot more (collective) expertise on radio technology if it hopes to not only not have to rely on China for critical radio-based infrastructure, but also to be able to upgrade US military command and control systems which, in the end, rely heavily on radio technology. Getting folks with a technical inclination interested in Amateur Radio can lead to getting educated on radio technology which can lead to becoming capable with radio technology and a lucrative and fulfilling career designing and making radio technology.

In service to this perspective, kudos to ARDC for "sweetening the pot" of the 2021-2022 ARRL scholarships. Godspeed, scholarship recipients, and please consider a career in radio technology. The US radio technology industry, and your country's military radio technology systems need you!

At least, that's my theory. See the "irrational exuberance" quote in Issue 0001.

Packet Radio Hardware In 2021

It's hard to sort out all the various Packet Radio hardware to buy or build in 2021, especially if you haven't been active in Packet Radio. If you're thinking about getting into Packet Radio (as in, 1200 / 2400 / 4800 / 9600 bps AFSK / FSK using AX.25 / FX.25), I strongly recommend watching this YouTube video from the 2018 MicroHAMS Digital Conference by John Langner, WB2OSZ on Dire Wolf Software TNC (link to John's slides). Dire Wolf is a (strained) acronym for "Decoded Information from Radio Emissions for Windows Or Linux Fans". (OK John, we'll play along :-)

After watching John's presentation, I'll guess that you'll come to the conclusion (as most of us have) that there is *very little* that "hardware" Terminal Node Controllers - TNCs (such as those listed below from Ham Radio Outlet) perform better than a computer, sound card, and Dire Wolf software. Dire Wolf is really, really amazing, especially now that it includes the option of FX.25 Forward Error Correction.

This article doesn't provide recommendations for radios or software - those merit their own articles. The "TNC-type" devices that are designed primarily for portable and mobile use with Automatic Packet Reporting System (APRS) also merit their own article.

What follows is some highly opinionated, highly subjective off the cuff advice and pointers about Packet Radio Hardware. First, a TNC is a "Terminal Node Controller". The first thing to know about that acronym is that "Terminal" refers to "Dumb Terminal" as in a physical, dedicated piece of hardware that simply echoes ASCII text received to a display and sends keystrokes out; usually to / from an RS-232 port. (Yeah, we used to make hardware with that limited functionality back in the day.) Second, it was intended that there would eventually be NNCs - Network Node Controllers, which would be a more powerful device that would replace the simple digipeat functions built into TNCs. (We never really got NNCs, though we tried.)

Thus, "TNC-type" units have some onboard intelligence to go with the radio interface. Later, a "KISS Interface" for TNCs was developed to be able to move the "intelligence" to much more powerful personal computers instead of embedded in the TNC. This paradigm persists in "TNC-type" units available from Ham Radio Outlet (type in *tnc* as the search term) such as:

- Kantronics KAM XL
- Kantronics KPC-3 (various)
- KPC-9612XE USB
- Kenwood TM-D710G (includes a built-in TNC)
- MFJ MFJ-1270X
- Microsat APRS Voyager + GPS-RS232

- Mobilinkd TNC3
- Timewave PK-232SC
- Timewave PK-96/100

As far as I'm aware, the Kantronics KAM and KPC-3 and Timewave units are only lightly refreshed (such as a USB interface instead of RS-232) from their original designs in the 1980s / 1990s (as in still use through-hole chips and 8-bit processors). I'm intrigued that Kantronics seems to have upgraded the capabilities of the KPC-9612XE from the predecessor KPC-9612+. The MJF-1270X, APRS Voyager+, and TNC3 are newer designs.

Given the incredible power available in the most mundane computer available now… even the $10 Raspberry Pi Zero W, having any intelligence in the "modem" (such as a TNC) is largely wasted. Even the KISS interface "gets in the way" of new modes. Instead, development of new data modes in Amateur Radio has shifted almost entirely to the use of high fidelity audio interfaces that essentially digitize the entire audio bandwidth of a radio's transmit audio and receive audio. The best (in my opinion) audio interfaces do not use transformers, as transformers cause distortions in the audio for the most high-performance modes (such as VARA FM).

Another primary issue of using audio interfaces for Packet Radio is the troublesome issue of software keying the Push To Talk (PTT) circuit of a radio. Some sound interfaces use "VOX", sensing that audio is present on the output of the audio interface. Using VOX in packet radio is… "sub-optimum". *'Nuff said*. The best audio interfaces have PTT circuitry that is widely supported in popular software such as Dire Wolf.

"Audio Interface" units available from Ham Radio Outlet (type in *sound card* and *audio interface* as search terms) include:

- MFJ MFJ-1204 (various)
- Tigertronics SignaLink USB (various)
- Timewave Navigator
- Unified Microsystems SCI-6
- West Mountain RIGblaster (various)

I have no personal experience or knowledge of these other than the SignaLink USB, which is not suitable for the types of data modes I'm most interested in such as (the highest performance tier of) VARA FM because it includes a transformer in the audio path. Yes, there are hacks for this issue, and the most recent versions of the SignaLink USB are improved on this issue. For most modes that use Audio Frequency Shift Keying, or the "Narrow" mode of VARA FM, the SignaLink USB works great (I own three of them).

For the best options for "Advanced Packet Radio", I recommend that you "go direct" to the following vendors.

NW Digital Radio **Digital Radio Amateur Workstation (DRAWS)** - DRAWS is a Raspberry Pi accessory (Hardware Attached on Top - HAT) board that interfaces with a Raspberry Pi. DRAWS includes a highly optimized audio interface for advanced Amateur Radio modes. DRAWS has a hardware PTT circuit that's widely supported. DRAWS was essentially designed to use Dire Wolf Software TNC, and it does so very capably. DRAWS incorporates a number of very useful features such the ability to use two radios, GPS receiver, analog inputs, and a 12 volt input that can power the entire system including the Raspberry Pi. DRAWS also includes a very cool case. It's not described very well, but DRAWS can be purchased as a "turnkey" unit - contact NW Digital Radio for details. NW Digital Radio provides an "image" for the DRAWS that can be downloaded to get started. If you buy a DRAWS, you should be comfortable with Linux and its command line interface. *Disclaimer: I know all the principals of NW Digital Radio. This description is my personal opinion and experience, with no influence from NW Digital Radio.*

WB7FHC / AG7GN Nexus DR-X - The Nexus DR-X is a Raspberry Pi accessory (Hardware Attached on Top - HAT) board that interfaces with a Raspberry Pi and a Raspberry Pi audio interface. The Nexus DR-X has a hardware PTT circuit that's supported in the Nexus DR-X software image. The Nexus DR-X is supplied as a kit (some build services are available). Nexus DR-X incorporates a number of very useful features such as the ability to use two radios, a 12 volt input that can power the entire system including the Raspberry Pi, some switches that can enable different startup options, and a safe shutdown pushbutton. The build instructions are excellent. The Nexus DR-X began as a local project here in Whatcom County, WA by Budd Churchward WB7FHC, but is now available as a kit for anyone to build, and Nexus DR-X units are in use all over the world.

What really makes the Nexus DR-X shine is the very tightly coupled software image for the Nexus DR-X by Steve Magnuson AG7GN. Budd and Steve work very closely together and the Nexus DR-X software is smooth thanks to AG7GN's experience and attention to detail, and well-tested thanks to the many Nexus DR-X users in Whatcom County and elsewhere. If you're comfortable with a soldering iron (all through-hole parts, no surface mount components) I recommend the Nexus DR-X as a fun kit to build. Note that you'll have to source some cables, and a MicroSD card, and download the image - all part of the kit assembly fun. *Disclaimer: I know WB7FHC and AG7GN. This description is my personal opinion and experience, with no influence from either of them.*

Masters Communications Digital Radio Adapter (DRA) series of audio interfaces. These devices, particularly the DRA-45 and DRA-50 have emerged as the preferred, best performance, most reliable audio interfaces for using VARA FM, primarily because they have "flat audio" response and additional audio amplification needed to drive some radios to full deviation. The DRA series have a hardware PTT circuit that's widely supported. Masters Communications has very long experience with audio interfaces for radio use, such as repeaters.

Terrestrial Amateur Packet Radio Network (TARPN) Nino-TNC - This is a designed from scratch KISS TNC with a USB interface capable of 9600 bps packet radio, and an optional unique new Forward Error Correction (FEC) protocol called Improved Layer-2 Protocol (IL2P). TAPRN's philosophy with the Nino-TNC is that software TNCs using audio interfaces are "too fussy" and "TNCs are much simpler" for average Amateur Radio Operators. What you buy with the Nino-TNC is a printed circuit board and the (programmed) processor. (There are

some individuals that sell assembled units.) All the components are through-hole, so it's relatively easy to assemble. Part of the "fun" of the Nino-TNC is that you have to individually source all of the components, though it's easier than it sounds as the Nino-TNC team provides "Bill of Material" lists for Digi-Key (willing to sell as little as one resistor). I've read that the build instructions are excellent.

The Nino-TNC is designed to be mated with a Raspberry Pi-based "TARPN Node" / "TARPN Node Stack, and the corresponding software to support the TARPN model of networking.

My experience is that I bought several very early versions of the Nino-TNC but didn't get around to assembling them. In the months following my purchase, the Nino-TNC was considerably improved, and I deemed it not worth trying to assemble my early revision boards. I elected to buy a pre-assembled late-model board revision. I look forward to experimenting with them this Summer.

The Nino-TNC and its associated Node Stack is only part of the bigger picture of TAPRN's mission of recreating Amateur Packet Radio networks using mature Packet Radio software (such as the G8BPQ suite) running on Raspberry Pi computers. See the main TARPN website for their interesting story.

TNCPi9k6 - A 9600 bps KISS TNC for a Raspberry Pi designed by John Wiseman G8BPQ, and was briefly produced by Coastal Chipworks (which has since ceased operations). The design was apparently made open source and is now available as a project of the West Valley Amateur Radio Club (Sun City, AZ) as a fundraiser. I bought several of these units and look forward to experimenting with them this Summer.

Unsigned.io OpenModem TNC - I know nothing about this product other than the vendor's description. OpenModem has a unique capability of logging AX.25 packets to an SD card for later analysis.

Ham Radio Projects DINAH - This audio interface is streamlined to a USB connector on one end of its sturdy metal enclosure and a 6-pin MiniDIN connector and two LEDs on the other end. It's reported to work on 9600 bps FSK packet radio (using Dire Wolf) by two local Amateur Radio Operators.

MFJ MFJ-1270PI (Ham Radio Outlet link) - This is a OEM, assembled and tested version of the Coastal Chipworks TNC-Pi (1200 bps AFSK) KISS TNC for Raspberry Pi. It is supported by some significant Packet Radio software for the Raspberry Pi such as PiGate.

ARDC, One More Time

I've written a lot about Amateur Radio Digital Communications (ARDC) mostly because for all the good works ARDC has done in 2020 and 2021 to date, they haven't done much outbound public relations (evangelism). That has now changed with the hiring of Dan Romanchik KB6NU as Content Manager. I was an early advocate of ARDC needing a full time writer, and I'm delighted that Dan was available and willing, and that ARDC chose Dan. Dan's a great writer, with a lot of depth in Amateur Radio, and that's really needed for the unique position of Content Manager for ARDC.

I certainly won't be ignoring ARDC in future issues of Zero Retries, but Dan can do a better job of explaining ARDC's progress better than I can (and, as an employee of ARDC, has official sanction to do so). So here are some last blurbs about ARDC that I think Zero Retries Readers should know about.

- See Dan's article on the ARDC website - ARDC Grants Support Amateur Radio Clubs as examples of how ARDC is helping Amateur Radio via helping Amateur Radio clubs. Nice article, Dan!
- I know it doesn't appear to be the case, but the link on the ARDC website https://www.ampr.org/news-and-updates/ is actually a "blog engine" with a corresponding RSS feed. If you're one of us that uses an RSS feed reader to keep up with articles published on websites, just plug that URL into your RSS feed reader and you'll see updates of that page in your RSS feed reader.
- See Dan's article (on his *personal* blog) about his new position with ARDC, and subscribing to the ARDC Newsletter, and ARDC's Twitter feed.
- ARDC's (new) newsletter is out - July, 2021 issue. Archives are on the newsletter sign up page. (Unfortunately, no RSS feed for the newsletter that I could find.)
- ARDC will be hosting a "Community Meeting" on Saturday, 24 July 2021 at 1700 UTC (10am PT / 1pm ET / 7pm CET) via Zoom. This is one of the few times that ordinary Amateur Radio Operators can interact directly with ARDC and perhaps ARDC Board Members. "See you" there!

Feedback Loop

Chris Doutre KC9AD

> I just finished reading Zero Retries, along with many, many linked articles, and I must say, I am extremely impressed. Nice work.

Dewayne Hendricks WA8DZP

> Just wanted to give you some feedback on your first edition of 'Zero Retries'. I read it over twice this past weekend and found it quite enjoyable reading. Liked the range of topics which you covered. I've passed link to it along to some of my ham friends and also to some of my mentees, who are not hams. This is the way...

Closing The Channel

It's a privilege bringing Zero Retries to so many readers.

For the immediate future, Zero Retries will remain an experiment in progress. If you have ideas, please email me - steve.stroh@gmail.com. I'm especially interested in content ideas about things that you'd like to see discussed in Zero Retries. If you write me, I may ask if I can

quote you (only with your permission) in Zero Retries.

If you're enjoying Zero Retries, please tell your friends and co-conspirators. For the first "little while" of Zero Retries, I'm not going to make any major publicity pushes; I'm curious to see how word of mouth will work.

Contributors this issue:

- Dan Romanchik KB6NU - info on the new ARDC newsletter.
- Kenny Richards KU7M - info on DINAH.

Thanks for reading!
Steve Stroh N8GNJ
Bellingham, Washington, USA
2021-07-23
Copyright © 2021 by Steven K. Stroh

Below is a much more complete "footer" that has evolved over 30+ issues of ZR.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, here are some pointers:

- **Ham Radio for Dummies** by Ward Silver N0AX is a great overview of Amateur Radio. N0AX is a gifted writer and HRFD is now in its 4th edition.
- My two favorite **YouTube** channels for a good overview of Amateur Radio are AmateurLogic.TV. and Ham Nation (part of Ham Radio Crash Course). These folks just seem to have so much fun!
- Radio Amateur Training Planning and Activities Committee (**RATPAC**) offers weekly presentations on general Amateur Radio topics (Wednesdays) and emergency communications in Amateur Radio (Thursdays).
- Dan Romanchik KB6NU offers a free **No-Nonsense Study Guide** for the Technician test (PDF).
- HamExam.org Amateur Radio Practice Exams offers good **Flash Card and Practice Exams**.
- When you're ready to take an **Amateur Radio examination** (Tech, General, or Extra), W1MX - The MIT Amateur Radio Society offers remote exams, free for students and youngsters. *There are apparently many other remote exam options*.

Bonus - with an Amateur Radio license, you'll be more attractive on dates 😀

Closing the Channel

- In its mission to grow Amateur Radio and make it more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex!

- My ongoing Thanks to Tina Stroh KD7WSF for, well, *everything* and Bill Vodall W7NWP as *Zero Retries Instigator in Chief*.

- My ongoing Thanks to pseudostaffers Dan Romanchik KB6NU and Jeff Davis KE9V for continuing to spot, and write about "Zero Retries Interesting" type items, on their respective blogs, from Amateur Radio and beyond, that I don't spot on my own.

- Southgate Amateur Radio News consistently surfaces "Zero Retries Interesting" stories.

- The Substack email publishing platform makes Zero Retries possible. I recommend it for publishing newsletters.

If you see something interesting mentioned in Zero Retries and would like to search all the Zero Retries "Back Issues", that's now easy - just click:

Search Zero Retries

If you're reading this issue on the web and you'd like to see Zero Retries in your email Inbox every Friday afternoon, just click:

Subscribe now

If you're a fellow smart person that uses **RSS**, there *is* an **RSS feed for Zero Retries**.

Zero Retries is on Twitter @ZeroRetries - just click:

Zero Retries on Twitter

Please tell your friends and co-conspirators about Zero Retries - just click:

Share Zero Retries

Offering **feedback or comments** for Zero Retries is equally easy; yes, you guessed it… just click:

Leave a comment

Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc. I don't use such information in any way other than seeing that most subscribers actually do read Zero Retries.

All previous issues of Zero Retries are available without restriction (no paywalls). For some background, Zero Retries 0000 was the **Introduction Issue**. Zero Retries 0026 and Zero

Retries 0027 were a **2021 Year End Review** of Zero Retries.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*

- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ (He / Him)
These bits were handcrafted in beautiful Bellingham, Washington, USA

If you'd like to reuse an article in this issue, for example for club or other newsletters, just ask. Please provide credit for the content to me and any other authors.

Portions Copyright © 2021-2022 by Steven K. Stroh.

Blanket permission granted for TAPR to use any Steve Stroh content for the TAPR Packet Status Register (PSR) newsletter (I *owe* them from *way* back).